

CLAIMS

1. An alkali metal generating agent as a supply source of an alkali metal used in formation of a photocathode for emitting a photoelectron corresponding to 5 incident light or a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said alkali metal generating agent comprising:

an oxidizer comprising at least one tungstate with 10 an alkali metal ion as a counter cation; and a reducer for initiating a redox reaction with the oxidizer at a predetermined temperature to reduce the alkali metal ion,

wherein the substance amount ratio of the reducer 15 with respect to the tungstate is 1.9 or more but 50.1 or less.

2. An alkali metal generating agent as a supply source of an alkali metal used in formation of a photocathode for emitting a photoelectron corresponding to 20 incident light or a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said alkali metal generating agent comprising:

an oxidizer comprising at least one tungstate with 25 an alkali metal ion as a counter cation; and a reducer for initiating a redox reaction with the

oxidizer at a predetermined temperature to reduce the alkali metal ion,

wherein the substance amount ratio of the reducer with respect to the tungstate is 4.0 or more but 50.1 5 or less.

3. An alkali metal generating agent as a supply source of an alkali metal used in formation of a photo-cathode for emitting a photoelectron corresponding to incident light or a secondary-electron emitting surface 10 for emitting secondary electrons corresponding to an incident electron, said alkali metal generating agent comprising:

an oxidizer comprising at least one tungstate with an alkali metal ion as a counter cation; and

15 a reducer of Si for initiating a redox reaction with the oxidizer at a predetermined temperature to reduce the alkali metal ion.

4. An alkali metal generating agent as a supply source of an alkali metal which comprises at least Cs 20 and is used in formation of a photo-cathode for emitting a photoelectron corresponding to incident light or a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said alkali metal generating agent 25 comprising:

an oxidizer comprising at least one tungstate with

an alkali metal ion as a counter cation; and
a reducer for initiating a redox reaction with the
oxidizer at a predetermined temperature to reduce the
alkali metal ion.

5. An alkali metal generating agent according to
claim 4, wherein the tungstate is expressed by a
chemical formula R_2WO_4 , where R is Cs only or a metal
element comprising Cs together with at least one
selected from the group consisting of Na, Ka and Rb.

10. An alkali metal generating agent according to
claim 1, 2, 4 or 5, wherein the reducer is at least one
selected from the group consisting of Si, Zr, Ti, and
Al.

15. An alkali metal generating agent according to
any one of claims 1 to 3 and 6, wherein the tungstate
is expressed by a chemical formula R_2WO_4 , where R is at
least one metal element selected from the group
consisting of Na, Ka, Rb and Cs.

20. An alkali metal generating agent according to
any one of claims 1 to 7, the alkali metal generating
agent being of a powder form.

25. An alkali metal generating agent according to
any one of claims 1 to 7, the alkali metal generating
agent being formed in a pellet form having a
predetermined shape by compression molding.

10. An alkali metal generating device for

generating an alkali metal used in formation of a photo-cathode for emitting a photoelectron corresponding to incident light or a secondary-electron emitting surface for emitting secondary electrons 5 corresponding to an incident electron, said alkali metal generating device comprising:

10 a case;
a supply source housed in the case and comprising an alkali metal generating agent according to any one of claims 1 to 9; and

15 a discharge port provided in the case and adapted for discharging a vapor of the alkali metal generated in the supply source, from an interior space of the case housing the supply source, toward the exterior of the case.

11. An alkali metal generating device according to claim 10, wherein the case is made of a metal.

12. An alkali metal generating device according to claim 10 or 11, wherein the case comprises:

20 a hollow container of a metal having apertures at both ends and provided with the discharge port in a side face thereof; and

lid members of a metal covering the respective apertures at the both ends of the hollow container.

25 13. An alkali metal generating device according to claim 10 or 11, wherein the case is a hollow

container of a metal having apertures at both ends thereof,

wherein the apertures at the both ends of the hollow container are hermetically closed in a state in 5 which the hollow container secures an interior space for housing the alkali metal generating agent, and

wherein the discharge port is provided in at least one of the both ends of the hollow container hermetically closed.

10 14. An alkali metal generating device according to claim 10 or 11, wherein the alkali metal generating agent is formed in a pellet form having a predetermined shape,

wherein the case is comprised of a closed-end 15 container of a metal having a recess for housing the alkali metal generating agent, and a lid member of a metal welded to the closed-end container in a state in which the lid member covers an aperture of the recess, and

20 wherein the discharge port of the case is formed in a non-welded portion between the closed-end container and the lid member.

15. An alkali metal generating device according to any one of claims 10 to 14, further comprising a 25 glass ampule housing the entire case.

16. An alkali metal generating device according

to any one of claims 10 to 15, further comprising a heating device for initiating the redox reaction of the alkali metal generating agent to generate the vapor of the alkali metal.

5 17. An alkali metal generating device according to claim 16, wherein the heating device comprises a high-frequency supply for heating the alkali metal generating agent by high-frequency heating.

10 18. A photo-cathode for emitting a photoelectron corresponding to incident light, said photo-cathode comprising the alkali metal generated from an alkali metal generating agent according to any one of claims 1 to 9.

15 19. A photo-cathode for emitting a photoelectron corresponding to incident light, said photo-cathode comprising the alkali metal generated from an alkali metal generating device according to any one of claims 10 to 17.

20 20. A secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said secondary-electron emitting surface comprising the alkali metal generated from an alkali metal generating agent according to any one of claims 1 to 9.

25 21. A secondary-electron emitting surface for emitting secondary electrons corresponding to an

incident electron, said secondary-electron emitting surface comprising the alkali metal generated from an alkali metal generating device according to any one of claims 10 to 17.

5 22. An electron tube comprising a photo-cathode according to claim 18 or 19.

23. An electron tube according to claim 22, further comprising:

10 an electron multiplying part comprised of one or more dynodes each having a secondary-electron emitting surface for emitting secondary electrons in accordance with incidence of the photoelectron emitted from the photo-cathode; and

15 an anode for collecting the secondary electrons outputted from the electron multiplying part and extracting the collected secondary electrons as an electric current to the outside.

24. An electron tube according to claim 22, further comprising:

20 an anode for collecting the photoelectron emitted from the photo-cathode and extracting the collected photoelectron as an electric current to the outside.

25. An electron tube according to claim 22, said electron tube comprising an image tube having at least a fluorescent screen for converting the photoelectron emitted from the photo-cathode, into light.

26. An electron tube according to claim 22,
further comprising a streak tube comprising:

an accelerating electrode for accelerating the
photoelectron emitted from the photo-cathode;

5 a focusing electrode for focusing the
photoelectron accelerated by the accelerating
electrode;

an anode having an aperture through which the
photoelectron focused by the focusing electrode can
10 pass;

a deflecting electrode having a pair of electrode
plates opposed to each other and adapted to be able to
sweep the photoelectron having passed through the
aperture provided in the anode, in a predetermined
15 direction by a predetermined deflection voltage applied
between the pair of electrode plates; and

a fluorescent screen for converting the
photoelectron deflected by the deflecting electrode,
into light.

20 27. An electron tube comprising an electron
multiplying part comprised of one or more dynodes each
having a secondary-electron emitting surface according
to claim 20 or 21.

25 28. An electron tube according to claim 27,
further comprising:

a photo-cathode for emitting a photoelectron

corresponding to incident light, toward the electron multiplying part; and

an anode for collecting secondary electrons emitted from the electron multiplying part and
5 extracting the collected secondary electrons as an electric current to the outside.

29. A method of production of a photo-cathode comprising an alkali metal for emitting a photoelectron corresponding to incident light, said method comprising
10 the steps of:

preparing an alkali metal generating agent according to any one of claims 1 to 9, as a source of the alkali metal;

15 heating the alkali metal generating agent; and guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the photo-cathode.

30. A method of production of a photo-cathode comprising an alkali metal for emitting a photoelectron corresponding to incident light, said method comprising
20 the steps of:

preparing an alkali metal generating device according to any one of claims 10 to 17, as a source of the alkali metal;

25 heating the alkali metal generating agent housed in the case of the alkali metal generating device; and

guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the photo-cathode.

31. A method of production of a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said method comprising the steps of:

preparing an alkali metal generating agent according to any one of claims 1 to 9, as a source of the alkali metal;

heating the alkali metal generating agent; and guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the secondary-electron emitting surface.

15 32. A method of production of a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said method comprising the steps of:

preparing an alkali metal generating device according to any one of claims 10 to 17, as a source of the alkali metal;

heating the alkali metal generating agent housed in the case of the alkali metal generating device; and guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the secondary-electron emitting surface.

33. A method of production of an electron tube comprising at least a photo-cathode comprising an alkali metal for emitting a photoelectron corresponding to incident light, said method comprising the steps of:

5 preparing an alkali metal generating agent according to any one of claims 1 to 9, as a source of the alkali metal;

heating the alkali metal generating agent; and

10 guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the photo-cathode.

34. A method of production of an electron tube comprising at least a photo-cathode comprising an alkali metal for emitting a photoelectron corresponding to incident light, said method comprising the steps of:

 preparing an alkali metal generating device according to any one of claims 10 to 17, as a source of the alkali metal;

20 heating the alkali metal generating agent housed in the case of the alkali metal generating device; and
 guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the photo-cathode.

35. A method of production of an electron tube according to claim 33 or 34, wherein said electron tube comprises one selected from a photomultiplier tube, a

photo-tube, an image tube, and a streak tube.

36. A method of production of an electron tube comprising an electron multiplying part comprised of one or more dynodes each having a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said method comprising the steps of:

preparing an alkali metal generating agent according to any one of claims 1 to 9, as a source of 10 the alkali metal;

heating the alkali metal generating agent; and guiding the alkali metal generated by the heating of the alkali metal generating agent, to an area for formation of the secondary-electron emitting surface.

15 37. A method of production of an electron tube comprising an electron multiplying part comprised of one or more dynodes each having a secondary-electron emitting surface for emitting secondary electrons corresponding to an incident electron, said method comprising the steps of:

preparing an alkali metal generating device according to any one of claims 10 to 17, as a source of the alkali metal;

heating the alkali metal generating agent housed 25 in the case of the alkali metal generating device; and guiding the alkali metal generated by the heating

of the alkali metal generating agent, to an area for formation of the secondary-electron emitting surface.

38. A method of production of an electron tube according to claim 36 or 37, wherein said electron tube 5 comprises one selected from a photomultiplier tube, an image tube, and a streak tube.